

Maritime Travel and the Question of Provisions and Scurvy in a Chinese Context

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Introduction

In the long course of human history people have always been on the move. In fact, human history is characterized by a seemingly incessant process of migration. Even when the settlement of certain populations had reached its conclusive phase and the great cultural areas of the world had developed, there were still those who moved from one place to another in small or large numbers. The reasons for this movement are many. One can easily think of situations in which demographic and economic factors force people to look for a better place to reside, while voyages of discovery, inspired by whatever purpose, have always existed and been vividly remembered in the collective memory of many a nation.

When one approaches the subjects of voyages, travel, migration, etc., one must also take account of the importance of provisioning. In the West, in medieval times and after, a lack of provisions often led to the much feared nutritional deficiency disease scurvy. As is commonly known, the problem of scurvy has everything to do with vitamin C. The disease occurs when the level of vitamin C in the human body is too low, the result of a scarcity or total absence of fresh fruit or vegetables in the daily diet. Recent research has shown that the oxidation process of vitamin C in the bodies of Asian populations proceeds considerably faster than in those of others, e.g. Europeans, native South American Indians and Polynesians. This means that if the scourge of scurvy was already a threatening factor for European explorers, then, the Chinese must surely have had similar problems, unless they had means to ward against it. Since the Chinese have a long history of maritime activities, the need

for broad-based research that deals with this topic and its adjacent fields of study becomes more and more evident.

Since European explorers commonly had to cope with the problem of scurvy, many publications about the disease have been written over the centuries, from the first references in late medieval sources up to specialised monographs in modern times. Yet, moving across to the Asian world we find materials on this matter to be rather scanty. For instance, the Indian work *Yajurveda* that contains sacrificial sayings and prose texts, mentions—as is remarked by Kenneth Kiple—a disease the symptoms of which easily remind one of scurvy: a condition whereby the gums become spongy, recede and easily start to bleed.¹ Locating Chinese evidence is an even more complicated task. This scarcity of information makes it necessary to approach the subject from as many different angles as possible. Although the scope of this research is intended to be broad ranging, covering continental as well as maritime activities, it goes without saying that, for now, I will mainly focus on the maritime aspect. The survey here is far from all-encompassing. Rather, the aim is to establish a framework for further research and to give some first, very preliminary results.

Scurvy: A Short Survey

Although there is no unanimous agreement about the earliest mention of the occurrence of scurvy in history, it is likely that the disease has been around since time immemorial. Scurvy belongs to that category of ailments that are now commonly known as nutritional deficiency diseases. Scientific clarification of why poor diet leads to disease was only achieved after the series of breakthroughs in modern biochemistry and medicine of the end of the nineteenth and the beginning of the twentieth centuries. Prior to that there was much conjecture, but it was only the discovery of vitamins and, eventually, their isolation that led to the eradication of many diseases. Among the various deficiency diseases scurvy occupies a somewhat special place, achieving particular notoriety with the inception of long distance seafaring. In their feverish search for an alternative route to reach the riches of the Indian world in the latter part of the fifteenth century, Portuguese seafarers pushed ever further down the coast of Atlantic Africa. While the Islamic powers had control of the passage through the Middle East, only by reaching the Cape of Good Hope was the gate to the East finally breached. Yet, having been out on the ocean for months, the Portuguese noticed the development of a gruesome pathological condition that had a devastating effect on the crew. Swollen limbs, blue from internal haemorrhages, and ulcerating gums were the most typical symptoms of

¹ Kiple (1999), p. 411. The cautiousness with which scholars of historical pathology approach the matter is apparent from the fact that Kiple's assumption is not followed by others trying to pinpoint the earliest mention of scurvy. See also below.

this affliction that would haunt crews of all seafaring nations and take thousands of lives in the centuries to come. Vasco Da Gama would lose half of his crew during the voyages to and from India, and both the English and Dutch East India Companies had to contend with high mortality rates due to scurvy. The disease was not the only affliction that occurred during sea voyages, but it was one of the most fearsome. Moreover, the disease was not totally new. The Portuguese sailors might not have been aware of it, but a very similar disease had struck during a crusading campaign of the French army at Cairo two hundred years earlier. It was also endemic in the northern regions of Europe, especially in winter. Nevertheless, in this comparatively early period, scurvy and its occurrence were primarily regarded as characteristic of maritime environments.²

After its appearance, attempts were made to control the disease. In fact, a solution had actually already been found by the Portuguese when they learned that they could swiftly cure their scurvy-stricken crew by administering lemons and oranges to the afflicted. Paradoxically, this extremely effective method did not spread to become an accepted and widely used practice. In the course of time the connection between scurvy and diet was surmised, but, due to the lack of a scientific framework, not widely acknowledged nor definitively proven. The explanations by medical men were often blurred by repetitive digressions, and beliefs that foul air and the humid conditions of life at sea were the main causes of scurvy overshadowed the weight that was attached to the impact of nutrition. In the meantime new cures were found. Excellent results were achieved by the use of fresh vegetables procured at stopping places, and of a plant that came to be known as scurvy grass, which proved highly effective in repelling scurvy during polar expeditions. Sometimes spectacular cures were achieved, but in general progress was very slow.³ Scurvy was still a dreaded enemy and reared its ugly head in numerous situations: during war, in prisons, during periods of serious crop failure, and, of course, aboard ocean-going ships with explorative purposes as well as on slave ships.⁴

By the middle of the eighteenth century the medical approach towards scurvy had made considerable progress, shifting away from the deep-rooted theories that went back to the ancient, so-called, authorities, such as Hippocrates and Galen, which were deemed no longer sustainable. Nevertheless, this tendency did not immediately result in lasting break-throughs. A spectacular exception was the first controlled clinical experiment in history. In 1747 the British physician James Lind showed the effectiveness of lime juice in combatting

² Carpenter (1986), pp. 1-28.

³ A famous example is the story of the French sea captain Jacques Cartier whose appallingly afflicted crew was cured by the Native American population using a decoction of the leaves of a certain tree. There has been a fair amount of conjecture as to what plant the Native American Indian may have used. It is thought that the leaves of the cedar tree or pine needles, which appear to contain considerable amounts of vitamin C, may be the best candidates. Cf. Vogel (1973), p. 79.

⁴ Carpenter (1986), pp. 2-51.

scurvy. Yet, as Lind was criticised for not having clarified the exact reason for this effectiveness, new measures for preventing scurvy were not taken until 1795. Once lime juice was included in the diet of the British Royal Navy, mortality rates dropped dramatically, but the lack of scientific rationale behind the method led to the regular recurrence of the disease during expeditions and military campaigns until World War II. The discovery and isolation, in 1933, of vitamin C, and improvements in food preservation techniques finally eliminated the threat of scurvy, which was only to live on in history books, in spite of some sporadic sub-clinical cases in recent years.⁵

Remarkable Biochemical Findings

Scientific research into vitamin C or ascorbic acid did, of course, not stop with its discovery and isolation into crystals. In subsequent decades numerous publications have revealed the complexity of a biochemical substance that has not yet yielded all its secrets. Recently, intensive research has been directed towards the connection between vitamin C and the differentiation of haptoglobine types.

What has come to light is that the oxidation of vitamin C in the body differs between population groups. Human blood consists of one half plasma and one half bloodcells. One litre of plasma contains 70g of proteins, of which haptoglobin is one kind. Haptoglobin is an antioxidant that binds hemoglobin, the substance present in the red blood cells that enables those cells to transport oxygen from the lungs to all parts of the body. A specific characteristic of haptoglobin is that it prevents hemoglobin from escaping from the cells, and another distinctive feature is its polymorphism, which means that there are different types. Humans have three types of haptoglobin: Hp 1-1, Hp 2-1, and Hp 2-2. It was found that reference values for vitamin C in human serum are determined by the genetic polymorphism of haptoglobin. The lowest serum concentrations of vitamin C are found in Hp 2-2, the highest in Hp 1-1. As a result it was discovered that the oxidation of L-ascorbic acid to dehydro-L-ascorbic acid occurs faster in the case of carriers of the Hp 2-2 type.⁶ In the bloodgroup system of humans there are three different alleles coding for a polymorphism. The allele distribution differs according to population location. Haptoglobin has two alleles (1 and 2) that can be divided into 1-1, 2-1, and 2-2. Now, humans originally had the 1-1 type. Later on—probably in South India—a mutation towards 2-1 and 2-2 took place. Research has shown that there is a relatively high concentration of the Hp 2-2 type in East Asia and Southeast Asia,

⁵ Carpenter (1986), pp. 42-198.

⁶ Langlois et al. (1996), pp. 1589-1600.

whereas the 1-1 type is dominant among Europeans and predominant among native South American Indians and Polynesians.⁷

The results of this research raised a whole range of questions and have directly led to the forging of a link with sinology. If scurvy caused major problems for European expedition crews, did it—as one might possibly expect—have an even more deleterious effect on Chinese expedition crews? Or were the Chinese more expert in securing their provisions? Can Chinese sources confirm or refute the proposed assumption?

Methodological Note

In searching for useful information about living conditions aboard ships in Chinese history and, more specifically, provisions and scurvy, it is important to keep the scope of our research as broad as possible. In order to be able to answer the questions posed above, it is quite evident that our attention should first and foremost be concentrated on similar types of sources as those that have yielded data on scurvy in a Western context. However, to limit ourselves solely to these types would be to run the risk of missing a wide range of essential information. In this regard it needs first to be pointed out that the subject under scrutiny here is poorly documented in secondary literature. Writings on Chinese maritime history have usually concentrated on nautical technology, trade, migration, history of the various harbours, and so on. Our topics—sailors' food supplies and medical conditions aboard a ship—are not only very specialised, they involve multiple areas of study: nautical history, medicine, dietetics, and so forth. Information on these subjects—if mentioned at all—seems to end up in tiny footnotes or are treated indirectly. This can only have two explanations; either primary sources are insufficient to build up a detailed case, or the topic has never been studied before. With this in mind it will, nevertheless, be our purpose to present written sources or other pieces of evidence that constitute the material basis for this interdisciplinary research. In our search for fundamental material several areas will come to our aid. Not only is there the history of travel and expeditions in a maritime context, with their often well-known episodes in Chinese or Asian history, but also the results attained in such fields as military history, underwater archaeology, travel accounts of non-Chinese, etc.

⁷ Heremans and Schultze (1966), p. 390.

Searching in Chinese Maritime History

The history of Buddhism serves as our first port of call in our search for data. After Buddhism had spread through Central Asia to China via the Silk Road and sacred writings had been translated, local interpretations and the intermixing of Buddhism with indigenous religions emerged, an evolution which at a certain moment led to the urge to rediscover the original texts. That was the reason why in 399 AD the Chinese monk Faxian 法顯 undertook his famous trip to India. When we read the account of this hazardous journey, written down by Faxian's friend Buddhahadra, we get an idea of the terrible hardships this crew of Asian sailors encountered. Although we cannot find any substantial data on nutritional deficiency, the text is still a very precious document as it constitutes the earliest extant sea travel account in Chinese history. It appears that at that time the chain of Silk Road cities was a relatively reliable system to assure a safe passage through the desert and the high mountains. If travellers died, it was probably not because of a nutritional deficiency in their provisions, but due to bandit attacks, exhaustion, getting lost, or simply because there was a lack of food. All this concerns Faxian's outward trip over land. To get back to China the monk embarked on a ship in Sri Lanka, where he had been staying for two years, and headed for Java. After some time the ship met a major storm that continued for thirteen days. The vessel was damaged, repaired on an island and finally reached Java, where Faxian stayed for five months waiting for the right monsoon wind.

復隨他商人大船上，亦二百許人，齎五十日糧。以四月十六日發。法顯於博舶上安居。東北行趣廣州。一月餘日夜鼓二時遇黑風暴雨。商人賈可皆悉惶怖。(…)于時天多連陰，海師相望僻誤。遂經七十日，糧食水漿欲盡。取海鹹水作食。分好水人可得二升。遂便欲盡。商人議言。常行時政可五十日便到廣州。今已過期多日，將無僻邪。即便西北求岸。晝夜十二日到長廣郡界牢山南岸。便得好水菜。⁸

[He stayed in this country (i.e. Java) for five months.]
Again, he accompanied other merchants, [whose] large ships
had more than two hundred men aboard and provisions for

⁸ *Taishō Shinshū Daizōkyō*: vol. 51, p. 866, T2085: *Faxian Zhuan* (法顯傳).

fifty days. On the sixteenth day of the fourth month they set out. Faxian felt safe aboard the merchant ship. They took a northeasterly course and quickly advanced towards Guangzhou, but after a month and a few days, by the sound of the second watch, they met with violent winds and heavy rain. The merchant men and the traders were all filled with fear (...) At that time, for days on end the weather was continuously cloudy. The sailors looked at each other: they had been driven off course and had made a mistake. They had been sailing for more than seventy days now. Provisions and fresh water were almost used up. They took sea water to cook their meals. The fresh water was divided among the passengers. Each person received two *sheng* [of water]. Thereupon, it [i.e. the water] was about to be used up. The merchants discussed [the situation] and said: "The normal time to reach Guangzhou is fifty days. This time we have exceeded this period by many days. Are we not driven off course?" Then, they steered towards the northwest in search of land. After twelve days they reached the southern shore of Mountain Lao,⁹ bordering the county of Changguang. Subsequently, they obtained fresh water and vegetables.¹⁰

The information we can get from this account of Buddhahadra is highly interesting. It draws a vivid picture of life aboard a ship and the dangers of seafaring in those days. Moreover, it bears witness to the fact that as early as the fifth century relatively big ships crossed the open seas, not merely sailing near the coast. Remarkably, the ship¹¹ Faxian boarded had the capacity to accommodate two hundred men, and provisions apparently were clearly calculated and prepared for fifty days. Moreover, the account gives the reader the strong impression that under normal circumstances the ship would rather sail in a straight line from the harbour of departure to its destination than make stop-overs on the way. This obviously necessitated minute preparation.

⁹ This mountain is located on the Shandong peninsula at the boundary of the Prefecture of Changguang, modern Jiaozhou 膠州. See Giles (1956), p. 78.

¹⁰ Own translation.

¹¹ There is some disagreement among scholars on the origin of the ships on which Faxian returned to China. Some say they were both Indian, others, like R. K. Mookerji, state that the first ship was Indian, the second Chinese. See Mookerji (1957), pp. 32-33, 121.

In terms of proneness to scurvy, Chinese and Indians offer an equally interesting case as both show a relatively higher chance of having problems with scurvy in extraordinary circumstances such as sea voyages. Cf. Langlois et al. (1996).

Unfortunately, nowhere in the account is mention made of what the provisions exactly consisted of or how they were stored and preserved.¹²

In the course of the centuries numerous countries were visited by the Chinese.¹³ By the time Faxian crossed the waters of the Indian Ocean and the South China sea, China's maritime activities had already been developing for several centuries. In pre-Han times there had been numerous naval operations in Chinese waters and there were frequent maritime contacts with Southeast Asia. During the Western Han (206 BC-24 AD) these activities were further developed. The official history of that period, the *Qian Hanshu* 前漢書, mentions a sea route from Haikang 海康¹⁴ to Madras in southern India.¹⁵ After the Han dynasty, travel for diplomatic or other purposes further developed. In Wei 魏 (220-265) and Jin 晉 (265-420) times, Zhu Ying 朱應,¹⁶ Kang Tai 康泰¹⁷ and others visited several countries of Southeast Asia. Most of their accounts are now lost, but some fragments have been preserved in encyclopaedic works such as *Shuijing zhu* 水經注 (Commentary on the Waterways Classic),¹⁸ *Taiping Yulan* 太平御覽 (Imperial Review Encyclopaedia of the Taiping Era)¹⁹ and others. Kang Tai and Wan Zhen 萬震²⁰ give detailed geographical information about the maritime areas they visited. During the Sui dynasty (581-618) several diplomatic missions were carried out to the lands of the Malay Peninsula.

The Tang dynasty, in particular, was a period of intensive commercial expansion. Not only did the continental Silk Roads flourish as never before, but

¹² The fact that the very first things the crew obtained after having reached China's shores were fresh water and vegetables points to the high probability that vegetables had been part of the original diet upon leaving Java. These—doubtlessly pickled—vegetables added to the staple food *liang* 糧 (grain).

¹³ Niu Zhongxun (1985), pp. 184-189.

¹⁴ In Han times this was a district in the southwest of Guangzhou.

¹⁵ [*Qian*] *Hanshu*, chap. 28, pp. 1670-1671.

¹⁶ Author of *Funan yiwu zhi* 扶南異物志 (Records of Strange Things in Funan), third century. See more on Zhu Ying in Sun Guangqi (1989), pp. 191-193.

¹⁷ He travelled to the kingdoms of Southeast Asia about 260 AD on behalf of the ruler of Wu and wrote a book titled *Wushi waiguo zhuan* 吳時外國傳 (Account of Foreign Countries contemporary with Wu). Cf. Needham (1971), p. 449.

¹⁸ Compiled by Li Daoyuan 酈道元 in 515-524. Passages by Kang Tai can be found e.g. in chap. 1, p. 22 (*Funan zhuan* 扶南傳, Records on Funan).

¹⁹ Edited by Li Fang 李昉 et al. in 983. A passage from Kang Tai's writings can be found in chap. 69 (dibu 地部—yin引: Section on Countries—quotes).

²⁰ He was a traveller and a writer on foreign countries of the third century AD. One of his works is the *Nanzhou yiwu zhi* 南州異物志 (Strange Things of the South), preserved in *Taiping yulan*. Relevant information can be found in chap. 760 (*qiwu bu* 器物部—yin引: Section on Utensils—quotes). Cf. Needham (1971), p. 381, p. 600.

also their maritime counterparts were the scene of busy trading operations. This development, naturally, had an influence on the written documents of those times. Tang dynasty sources on maritime travels include the descriptions by the famous geographer Jia Dan 賈耽.²¹ These cover sea routes from China to the Persian Gulf and the coasts of East Africa, reflecting the geographical knowledge that resulted from the development of extensive travel in the Indian Ocean. Other sources are those of the eighth-century Du Huan 杜環²² and Duan Chengshi 段成式,²³ who produced quite detailed accounts of the countries of East Africa, and the writings of the above mentioned Buddhist monks who travelled to India in search of the Doctrine. The intensified shipping activity also finds its expression in the *Tang Yulin* 唐語林 (Collection of Tang Discourses), which is, in fact, a Song source but relates things about Tang matters. In a passage of this work from 1107, the author Wang Dang 王讜 gives a remarkable description of the living conditions aboard a particular kind of ship:

(...) 大船不過八九千石 (...) 間有俞大娘航船。最大居者養生送死婚嫁。悉在其間開巷為圃操駕之工數百 (...) ²⁴

(...) the large ships do not exceed 8,000-9,000 *shi* (...) Among them there are the *Yu Da Niang* ships, which are the largest. Those living [on them] spend their whole lives and marry on board. All [ships] have [dwellings] lanes in their sections and they have gardens. There are several hundreds of boatmen and technicians [on board] (...) ²⁵

As described, it appears that these ships served as homes to the sailors to such an extent that they even organised vegetable gardens. Evidently, the scarcity of concrete details about the techniques that were used to grow vegetables aboard

²¹ He wrote mainly between 785 and 805. Jia is said to have drawn a huge map entitled *Hainei huayitu* 海內華夷圖 (Map of the Hua and Barbarian Territories within the Seas). Information on Jia Dan can be found in the “Jia Dan zhuan” 賈耽傳 (Biography of Jia Dan) in *Jiu Tang shu* 舊唐書 (Old Standard History of the Tang), chap. 138. Cf. also Needham (1971), p. 661.

²² He was a military officer who had been made captive in the Battle of the Talas River (751) between Arab and Chinese forces. After his return from Arabia in 763 he wrote *Jingxing ji* 經行記 (Account of My Travels) of which only fragments have been preserved in—among others—*Tongdian* 通典, chap. 193. See Needham (1971), p. 495.

²³ This scholar compiled *Youyang zazu* 酉陽雜俎 (Miscellany of the Youyang Mountains) in 863, containing descriptions of the coast south of the Gulf of Aden (chap. 4, 3b). See Needham (1971), p. 494.

²⁴ *Tang yulin*, chap. 8, p. 3.

²⁵ Own translation.

the ship prevents us gaining a clearer picture of this phenomenon. Nor can we be sure that this was the result of an established tradition for Chinese seafarers.

Trade was not the only stimulus to navigation that deserves our attention. Faxian's example was followed many times in the ensuing centuries by Buddhists. One such was Yijing 義淨, who, departing from Guangzhou on a Persian ship, reached the East coast of India via the Malay Archipelago and the Nicobar Islands in 673. The accounts of these travels shed some light on Indian maritime activities at the time, but they provide only scanty information on the actual travel experience.²⁶ Later, around the middle of the eight century, Jian Zhen 鑑真, who for decades functioned as the only ordinating authority in Central China, was invited by Japanese monks to Japan to spread the monastic discipline there. For about ten years he tried to reach Japan, but failed due to shipwreck or poor navigation. Only the fifth attempt in the winter of 753/754 yielded success, when Jian Zhen, accompanied by twenty-four monks, finally set foot on Japanese soil. The story of these voyages has been preserved in the *Tang daheshang dongzhengzhuan* 唐大和上東征傳, and we are extremely fortunate that detailed data regarding provisions is provided in the description of the first attempt to reach Japan in 743:

(...) 備辦海糧：[落]脂²⁷紅綠米一百石，甜豉三十石，牛蘇一百八十斤，麵五十石，乾胡餅二車，乾蒸餅一車，乾薄餅一萬，番[捻]頭一半車(...) ²⁸

(...) for the voyage the following supplies were prepared:
100 piculs of dried rice, 30 piculs of sweet bean curd, 180 pounds of butter,²⁹ 50 piculs of flour, 2 cart loads of dried

²⁶ "Da Tang qiufa gaoseng zhuan," in *Taishō*, vol. 51, T.2066, 1-14; Takakusu (1896), Introduction, pp. 17-37. It should be pointed out that in Yijing's travel account mention is made of the purchase of bananas and coconuts from the natives of the Nicobar Islands, but it is unclear whether we are dealing with intended underway provisioning or some form of forced trade. Therefore, I shall not go further into this matter. Cf. Takakusu (1896), Introduction: p. 30.

²⁷ Hankó (2003), p. 249, points out that there are various explanations for *luozhi* 落脂. It is probably an alternative to *lingzhi* 苓脂, which in its turn corresponds with *fuling* 茯苓, a sort of mushroom. It is uncertain whether it actually refers to a mushroom or whether it is used as an epithet to stress the quality of the rice.

²⁸ *Tang daheshang dongzhengzhuan*, p. 47.

²⁹ In translating *su* 蘇, which is an error for *su* 酥, Hankó (2003), p. 249, opts for "cheese", yet according to Huang (2000), p. 255, this *su* is actually butter used as shortening for rolls and cakes.

bread, 1 cart load of dried steamed buns, 10,000 pieces of dried cakes, half a cart load of rolled pastry (...).³⁰

Finding such a detailed list of ship supplies to feed the 17 monks and 85 artisans that formed the crew is truly exceptional. The amounts seem to have been meticulously calculated. The absence of any vegetables in the diet is also remarkable, but since the voyage to Japan certainly did not last more than one or two weeks, any chance of scurvy is, theoretically speaking, ruled out here.

At the time when Wang Dang compiled *Tang yulin* a new era in navigation was heralded by the introduction of the compass. Commercial overseas activities continued to expand. The Song and Yuan empires maintained diplomatic relations with the countries of the Persian Gulf, Arabia, East Africa, etc. These developments were also favourable for the further expansion of knowledge about the countries involved, as is shown by *Lingwai daida* 嶺外代答 (Information on What is Beyond the Passes, 1178) of Zhou Qufei 周去非 and *Zhufan zhi* 著蕃志 (Records of Foreign Peoples, c. 1225) of Zhao Rugua 趙如适. Under the Yuan dynasty seafaring activities were based on the accomplishments of the Song. Eyewitness accounts from the Yuan documenting the boom in long distance travelling survive, such as *Zhenla fengtu ji* 真臘風土記 (Description of the Natural Conditions and Social Customs of Cambodia, 1297) and *Daoyi zhilüe* 島夷志略 (Records of the Barbarian Islands, 1350) written by two famous travellers, Zhou Daguan 周達觀 and Wang Dayuan 汪大遠 respectively.³¹ All these works contributed to the enrichment of the geographical knowledge of the Chinese about foreign lands from which later sea-orientated generations would benefit.

Non-Chinese sources also shed light on seafaring activities at this time. Many foreigners went to China, and in some cases wrote down their impressions and experiences. A particularly valuable account for our purposes is the work compiled by the Moroccan traveller Ibn Batutta, who visited China in the first half of the fourteenth century. At one stage of his journey the adventurer visited one of China's harbours, and while describing the junks he saw, he mentions that "... the sailors have their children living on board ship, and they cultivate green stuffs, vegetables and ginger in wooden tanks."³²

³⁰ Own translation. Gong Jinhan (1996), p. 47, adds cabbage to this list, yet there is no such term in the original text.

³¹ Gang (1999), pp. 8-19.

³² Gibb (1986), p. 236. This fragment is only to be found in Ibn Batutta's account. Chklovski's work on the Moroccan's famous predecessor Marco Polo leads us to believe that the Venetian was the first to write about the provisions of Chinese sailors, but this is not the case. Chklovski's text, translated by Slonim in 1948, is very poorly annotated and seems to be a kind of "apocryphal" or romanticised version. In none of the other scholarly editions of Polo's book there is mention of growing vegetables aboard a junk. Chklovski's unreliability also becomes clear when Marco Polo's home journey via Persia

This passage seems to corroborate the fragment in *Tang yulin*, confirming the technique of growing vegetables aboard ship. Providing the crew of an ocean-going ship with fresh vegetables in this way would be an excellent way to keep the sailors in good health, and to ward off any potential danger of scurvy.³³ As to the feasibility of growing greens on a vessel, several question marks remain because a range of practical obstacles need to be reckoned with, especially with regard to watering. The most reasonable candidate for growing aboard a vessel would be bean sprouts, because these grow very fast and are highly nutritional. In this respect T. H. Huang has shown that bean sprouts had become a “common article of food” by the time of the Song dynasty.³⁴ Unfortunately, their specific use by seafarers has not been clearly documented.³⁵

Ibn Batutta’s eyewitness report contains another interesting passage in which sailors’ provisions are further illustrated. It is from around the time when the traveller had decided to go to China. Before leaving from one of the Southeast Asian ports, Battuta describes the preparations for the voyage:

(...) she ordered me to be given robes, two elephant loads of rice, two buffaloes, ten sheep, four pounds of syrup and four martabans (that is, large jars) filled with ginger, pepper, lemons and mangoes, all of them salted, these being among the things prepared for sea voyages.³⁶

This is a much more detailed account giving us an actual survey of all the food products that were consumed aboard this Asian junk. Moreover, not only the foods are mentioned, but also the way in which they were preserved. The consumption of lemons attracts our attention, for if this was really a common food product in these circumstances—and we have few reasons to doubt Ibn Batutta’s account—then this means that Asian seafarers were eating lemons

is recounted. According to Chklovski’s version, the majority of the people died of a disease that caused the gums to become swollen, whereas the Venetians were saved by eating onions. This passage is absent from the more thorough studies carried out on the matter. Cf. Chklovski (1948), pp. 180-181.

³³ It is worth pointing out that so far no additional data have emerged from ancient Chinese works that may explain the principles of the technique reflected in these passages.

³⁴ Huang (2000), p. 296.

³⁵ Evidence on this subject may not be entirely lacking. There is a story about an American adventurer by the name of Samuel Bowen who went to China in 1758, and while in Canton noticed the technique of soybean sprouting, which was done on land and at sea. Consequently Bowen introduced the soybean to North America. See Hymowitz and Harlan (1983), p. 373. Another case is that of a certain Edmund Fanning, an American skipper whose ship was engaged in the seal fur trade from the South Polar Seas to China, and who had learnt from the Malays to sprout peas and thereby ward off scurvy. Cf. Nixon (1944), p. 511.

³⁶ Gibb (1986), pp. 280-281.

during their sea voyages at least two or three centuries before they were introduced aboard Western ships in order to cure or ward off scurvy. The nutritional value of fruits seems also to have been acknowledged by Chinese sailors.³⁷ That is, at least, the conclusion drawn from the excavation of the wreck of a Song vessel in 1973. The junk still contained the remains of various kinds of meat and fruit. Despite the incompleteness of the diet (lack of a staple crop, for instance) these finds provide an irrefutable piece of evidence.³⁸

A brilliant chapter in the maritime history of China is constituted by the fantastic exploits of Zheng He in the first half of the fifteenth century. The sagacious Muslim eunuch commanded seven major expeditions to Southeast and Western Asia, the meaning of which can best be understood within the framework of tribute relations and diplomacy. During the Ming dynasty, commerce was considered as unworthy of the great China and contrary to the Confucian viewpoint. This meant a rupture with the flourishing commercial activities of the Song (960-1279) and Yuan (1271-1368) dynasties and a return to the traditional values of ancient China. The only possibility was tribute relations: China regarded the countries of the outside world as vassals of its emperor to whom they had to bring tribute, by this acknowledging her sovereignty. In exchange China offered gifts and protection.³⁹ The expeditions took place between 1405 and 1433, and more than thirty countries (ranging from the Malay Peninsula to the East African coast) were visited by Zheng He 鄭和 or his admirals. As there is no actual logbook of the voyages and the personal accounts of Zheng He were destroyed soon after the expeditions, we have to rely on the remaining sources, e.g. the accounts *Yingya shenglan* 瀛涯勝覽 (The Overall Survey of the Ocean's Shores) by Ma Huan 馬歡, *Xingcha shenglan* 星槎勝覽 (The Overall Survey of the Star Raft) by Fei Xin 費信, and *Xiyang fanguo zhi* 西洋蕃國志 (Record of the Foreign Countries in the Western Oceans) by Gong Zhen 鞏真, all of whom were on the expeditions, and on

³⁷ Fruits crop up in a case from a later time and in a Korean setting. It concerns the sea voyage of Ch'oe Pu, a Korean official who was in service on the isle of Cheju in 1487. Upon hearing the news of his father's death he returned to the Korean Peninsula, but his ship was caught by a storm and blown toward China. Aboard the ship conditions daily worsened. Ch'oe Pu's diary states: "... these oranges and this wine are all there are. One drop is worth a thousand pieces of gold. You take charge, therefore, and do not waste any, so that they can be used to relieve the thirst of the men in the boat ... Hyo-ja inspected the men and gave those whose lips were parched and mouths cankerous some oranges and wine to eat and drink. He gave them only enough to moisten their tongues ..." While the 'cankorous mouths' may remind us of the calamitous condition of a scurvy patient, the description most probably does not refer to the disease due to the extremely short sailing distance. Nevertheless, the account gives us a striking impression of a critical situation at sea and what those on board actually ate. See Meskill (1965), pp. 38-39.

³⁸ Quanzhouwan Songdai haichuan fajue baogao bianxiezhu (1975), p. 5 and p. 14.

³⁹ Lelièvre (1996), pp. 111-113.

Zheng He's biography 鄭和傳 (*Zheng He zhuan*) in *Mingshi* 明史 (History of the Ming; chapter 304), the stone inscriptions found in various countries where the Chinese disembarked, etc. Strikingly enough, very little is said about provisions. Nevertheless, if you take into account that the biggest expeditions involved up to three hundred ships and about 27,000 men, preparations must have been extremely thorough. In fact, it was often more than a year before each fleet could actually put out to sea. The fleet had various kinds of ships: apart from the famous gigantic 'treasure ships' and battle ships, there were also supply ships and tankers containing huge amounts of fresh water. Aboard the ships there were real kitchens in which cooking personnel prepared the meals for the fleet.

The crew consisted of a wide range of professionals, including a considerable number of doctors, on average about one per 150 crew members. These, of course, played a crucial role in securing the health of the crew. They had the special task of collecting medicinal herbs in the countries that were visited by the fleet. In fact, most information about ancient Chinese maritime medicine can be derived from the materials on the voyages of the 'Starcraft,' such as those cited above. Zheng He's ship doctors were experienced people, either dispatched by the Imperial Academy of Medicine (*taiyiyuan* 太醫院) or recruited among the people. Some of them are even known by name, for example Kuang Yu 匡愚, Chen Yicheng 陳一誠, Peng Zheng 彭正, etc.⁴⁰ It is unclear, however, whether they had cases of scurvy to deal with during the expeditions.⁴¹

What sailors exactly ate aboard the numerous junks that participated in the expeditions remains somewhat unclear. The difficulty here is that the surviving sources mention next to nothing about the ways in which the huge complement of sailors were supplied with the necessary foodstuffs. *Yingya shenglan*, Ma Huan's account of the countries the fleet visited, contains extensive descriptions of the local livestock, plants, and minerals.⁴² This information is so substantial that it has led some scholars believe that it could refer indirectly to provisioning.

⁴⁰ The biographies of several of these physicians can be found in *Qinding gujin tushu jicheng*, Vol. 46, chap. 531, pp. 5587, 5589.

⁴¹ Documentation on the field of maritime medicine in Chinese history appears to be extremely scanty and fragmentary. Nevertheless, as early as the period of the Warring States traces of maritime medicine can be found in the story by Zhuangzi 莊子, "Xiao-yaoyou" 逍遙游, that mentions a kind of medicine used by sailors to avoid chapped hands (*Zhuangzi*, vol. 1, chap. 1, pp. 27-28). During the Qin dynasty (221-207 BC) 秦, a man from Qi 齊, Xufu 徐福, accompanied by 3,000 people, undertook a voyage overseas in search of divine drugs. He took along several herbs that have practical use in disease treatment and prevention. Similar references can be found in accounts dating back to the Eastern Han 東漢 (25-220), Tang and Song Dynasties, but these are of minor importance here. See Gong Jinhan (1996), p. 47.

⁴² *Yingya shenglan*, p.11, e.g. the fruits of Java: 芭蕉子 *bajiaozi* (banana), 椰子 *yezi* (coconut), 甘蔗 *ganzhe* (sugar-cane), 石榴 *shiliu* (pomegranate) etc.

We know that the fleets contained a number of supply ships storing grain and water.⁴³ As a matter of course, the fleet could also replenish its reserves underway, e.g. on the Maldiv Islands.⁴⁴ Moreover, Zheng He had a base in Malacca where ships could be repaired and supplied with victuals.⁴⁵ As has been stated before, information about these victuals is sketchy, though there is one exception of considerable importance. A passage in Gong Zhen's work refers to the consumption of tea among the officials aboard the ships:

(...) 一下西洋的内官合用鹽醬茶酒油燭等件 (...).⁴⁶

(...) the officials going to the Western Oceans share the use of salt, [soy] sauce, tea, wine, oil, and other commodities (...).⁴⁷

As is commonly known, tea drinking was common in China by the Tang dynasty so it is not unreasonable to assume that the Chinese would continue the habit aboard their ships. The nutritional value of tea has not only long since been acknowledged in Chinese medicine but is confirmed by Western medicine. Biochemical analyses have shown the presence of a small amount of vitamin C in tea leaves. It would be somewhat premature to draw the conclusion that during the expeditions scurvy was avoided solely by drinking tea, but the beneficial contribution of the beverage to the diet cannot be denied.⁴⁸

After the short-lived period of ocean-going exploration, China's maritime supremacy rapidly declined. The expeditions were suspended, junks and shipyards abandoned, and prohibitions on shipbuilding and maritime activities promulgated. Nevertheless, Chinese junks continued to sail the Eastern seas. During the Qing dynasty (1644-1911) they were engaged in trade between the Japanese port of Nagasaki and various ports in Southeast Asia. A number of documents have been preserved that were written down by a Chinese interpreter after an interview with a representative of each incoming junk. These manuscripts, created by order of the Japanese authorities, are ship reports containing information on the voyage. One such report has an interesting passage on provisioning. The representative recounted how his ship came from

⁴³ Zheng Yijun (1985), p. 104.

⁴⁴ There is a reference to the purchase of coconuts by Zheng He's ships in this region, but the passage does not clarify whether these were used as provisions for the crew or as material for the manufacture of tools, such as ship ropes. Cf. *Yingya shenglan*, p. 52.

⁴⁵ *Yingya shenglan*, p. 25.

⁴⁶ *Xiyang fanguo zhi*, p. 16.

⁴⁷ Own translation.

⁴⁸ Chen Zongmao (2000), p. 347.

the port of Kelapa in Java, and was confronted with provisional difficulties that forced the ship to make a detour to Xiamen:

After we left Kelapa we began to run out of drinking water at sea. On the 26th day of the 6th month [23 July 1688] we called at Xiamen to procure water, fuel and vegetables, and we left there on the 3rd day of this month. We did not stop anywhere else apart from Xiamen (...).⁴⁹

The presence of vegetables in the sailors' diet is, of course, of utmost importance, and remarkable, too, is the relatively long sailing time of about a month. Indeed, some of the reports speak of sailing times of up to 85 days. Clearly Chinese junks were capable of staying out at sea for a considerable length of time.

The consumption of vegetables aboard Chinese junks is confirmed by a later account of a Western traveller in Southeast Asia. In 1822 John Crawford stayed in Siam (present day Thailand) as an ambassador. One day he spotted a Chinese junk in one of Siam's harbours. Curiosity drove him to ask permission to board the vessel and have a look inside. What follows in his account is a vivid picture of the life aboard a Chinese vessel, and, fortunately, Crawford also touches upon the food:

They pressed us to sit down, to eat with them, to drink tea with them, and to smoke their pipes. (...) The Chinese sailors are of course fed, and at sea receive salt pork, salt fish, occasionally poultry, with rice, and sour or salt krait; and when in harbour, they receive fresh animal food and fresh vegetables.⁵⁰

We do not know how far this practice of eating preserved vegetables at sea goes back in time, but we can be sure that there is no connection with Western seafaring whatsoever. Captain James Cook's successful experiment with sauerkraut is highly unlikely to have penetrated into China, a country that has a long tradition of preserved cabbage of its own. The same can be said for tea. In Crawford's account we get further confirmation of the use of tea aboard Chinese junks. In view of the nutritional benefits of tea it would imply that Chinese sailors, when going to at sea, carried with them as it were a small 'preventive'

⁴⁹ Ishii Yoneo (1998), p. 214. Ishii has made a selection from a modern Japanese translation of the original documents, called *Tōsen fusetsu-gaki* 唐船風説書 (Reports on Chinese Ships), which were edited by Hayashi Harukatsu 林春勝 and Hayashi Nobutoku 林信篤 (1958-1959), titled *Ka-i Hentai* 華夷變態 (Changes among Chinese and Barbarians), and has translated them into English.

⁵⁰ Crawford (1967), pp. 48-49.

package which could avoid or at least postpone the possible occurrence of nutritional problems.

In order to provide a more complete picture on provisions and scurvy we have to search for actual occurrences of scurvy among Chinese individuals. These are not easy to find, but there are a few cases documented. One outbreak occurred during the Gold Rush in the nineteenth century. When news of the discovery of gold in California reached Guangzhou, many Chinese saw the potential for a new future in the land across the ocean, so, in often miserable conditions, they traversed the Pacific, a voyage that more than once ended in disaster. In 1854 one-fifth of the Chinese on board of the *Libertad* died of scurvy and ship's fever. In the same year 86 out of 613 Chinese aboard the *Exchange* perished due to scurvy.⁵¹ North America was not the only destination. An acute shortage of labour in South America attracted many workers who first had to cross the immense water barrier, and, here too, scurvy inevitably showed up. Fairly precise numbers are available for the Chinese 'coolies' that arrived in Callao, Peru, in 1874. Reportedly, more than 30 percent of the Chinese aboard had died of scurvy.⁵²

Qingtui yagan 青腿牙疳: Scurvy in the Qing Army

In searching for instances of scurvy among Chinese, we have to turn away from the maritime sector and consult medical sources instead. It goes without saying that we are not looking for anything involving the modern Chinese term *huaixuebing* 壞血病, which is a translation of the Western word *scurvy*. It was, indeed, rather intriguing to find out whether in the long history of traditional Chinese medicine something could be found on scurvy.⁵³ Nutritional deficiency diseases have been dealt with elsewhere by H. T. Huang, who provides historical background on the occurrence of four other deficiency diseases in Chinese history: goiter, beriberi, night blindness, and rickets.⁵⁴ He does not mention scurvy,

⁵¹ Chu (1967), pp. 30-32. The subject of scurvy victims during Pacific crossings is currently being further researched. More concrete data may possibly be expected from documents regarding the registration of the arriving Chinese.

⁵² Stewart (1970), p. 67.

⁵³ Nutritional deficiencies certainly were an issue for physicians in pre-modern China. To give just one example, *Ishinpō* (or *Yi xin fang* in Chinese), the oldest known, still extant Japanese work on medicine, was compiled in the tenth century by Tamba Yasuyori (911-995), and contains fragments and quotations from a large number of medical works dating back to Sui and Tang times. Chapter 8 of this work deals with 'Nutritional Deficiency, Diseases of the Extremities,' but, remarkably, scurvy is not mentioned. This may indicate that scurvy did not occur or had not been identified as such a kind of disease at that time. Cf. Hsia et al. (1986), pp. 1-26; *Yixin fang*, pp. 599-632.

⁵⁴ Huang (2000), pp. 571-591.

however. Fortunately, there is an impressive source from Qing times describing a disease that can hardly be anything other than scurvy. The *Yizong jinjian* 醫宗金鑑 (The Golden Mirror of Medicine), compiled by Wu Qian 吳謙 in 1742, gives an extremely accurate depiction of scurvy, as perceived through Chinese eyes. The disease is called *qingtui yagan* 青腿牙疳. Its appearance and consecutive stages are elaborated, beginning with the bleeding gums and blue spots on the legs, gradually deteriorating towards foul breath, teeth falling out, legs becoming black, and ending in the total collapse and rotting of the body.

青腿牙疳何故生。只緣上下不交通，陽火
炎熾陰寒閉凝結為毒。此病成，青腿如雲
茄黑色，疲頑腫硬，履難行，牙疳齦腫出
臭血，穿破腮唇腐黑凶。⁵⁵

As for *qingtui yagan* [i.e. scurvy], why does it develop? It is only because up and down do not communicate. When *yanghuo* flares up and *yinhan* is blocked, the coagulation makes poison. When the disease has developed, the blue legs are like clouds and have the black color of the egg-plant. They [i.e. the legs] are tired, corrupted, swollen, and walking is difficult. The teeth are ulcerated and the gums are swollen and secrete stinking blood. The pierced and ruined jaws and lips are rotten, black and malignant.⁵⁶

These are exactly the characteristic symptoms of scurvy as we encounter them in so many Western medieval maritime sources. Next, historical background is given to show where the disease was first spotted. We read that scurvy is only rarely mentioned in the old medical books, but that in the Yongzheng reign-period (1723-1735), a military physician Tao Qilin 陶起麟 had encountered cases of scurvy, though they were quite rare, in a camp in the north, outside the Chinese borders. He attributed the emergence of the affliction to living in cold and damp places and particularly to the lack of the five crops.

此證自古方書罕載其名，僅傳雍正年間，
北路隨營醫官陶起麟頗得其詳。略云：軍
中凡病腿腫色青者其上必發牙疳；凡病
牙疳腐血者，其下必發青腿(...)蓋中國之
人，本不耐邊外嚴寒，更不免坐臥濕地，

⁵⁵ *Yizong jinjian*, vol. II, p. 316.

⁵⁶ Own translation.

故寒濕之痰生於下，至腿青腫 (...) 又緣邊外缺少五谷 (...).⁵⁷

As to this disease, its name has rarely been mentioned in medical books since antiquity. It was only recorded in the Yongzheng period. The medical officer Tao Qilin, who accompanied a camp of the Northern Route (beilu 北路), obtained its details. He gives an outline saying: “Whenever the soldiers suffer from swollen legs of blue colour, the gums will be ulcerated above; whenever they suffer from swollen gums with rotten blood, their legs will be blue below (...). The Chinese originally [not only] cannot endure the severe cold from across the borders, but now cannot even avoid sitting and lying on damp and cold places (...). Another cause is that across the borders the five cereals are lacking (...).”⁵⁸

As a treatment he suggests taking horse milk and even horse brain, these being extremely effective. This nutritional cure is combined with the intake of several decoctions for restoring inner balance, cooling down the humid heat that characterizes scurvy as perceived by traditional Chinese medicine. Furthermore, the text expresses the clear view that bad blood should be removed from the blue spots or hemorrhages on the legs by means of three-edged needles. After the bloodletting, strips of beef are attached to the wounds in order to further extract foul blood. A healing ointment is then applied to deal with the wounds.

僅有令服馬乳之法 (...) 較馬乳為效倍速 (...) 服馬腦治青腿牙疳 (...) 活絡流氣飲 (...) 加味二妙湯 (...) 砭刺出血法，此法用三棱扁針 (...) 向腿之青黑處 (...) 外以牛肉割片，貼針眼并黑處 (...) 搽牙牛黃青黛散 (...).⁵⁹

The only method to cure the disease was by means of horse milk⁶⁰ (...) He found out that horse brain was twice as efficient as horse milk (...) Curing *qingtui yagan* with horse

⁵⁷ *Yizong jinjian*, p. 317.

⁵⁸ Own translation.

⁵⁹ *Idem*, pp. 317-319.

⁶⁰ It should be remarked here that according to biochemical analyses horse milk appears to contain vitamin C. (Private communication with Prof Dr Delanghe, Ghent University Hospital). Huang (2000), p. 248, remarks that it is the essential foodstuff containing vitamin C in the diet of pastoral people who are not accustomed to growing vegetables.

brain (...). The *huoluo liuqi* decoction (...). The *jiawei er-miao* decoction (...). The method of bloodletting by means of needles: this method makes use of three-edged needles (...) Insert them [the needles] into the blue and black spots on the legs (...) On the outside, press slices of beef to the holes left by the needles and the black spots (...). Ointment of the teeth with bezoar and indigo powder (...).⁶¹

Finally, after the description of a few additional treatments, the text explains those cases where the disease cannot be cured.

Clearly this is an extremely valuable source that yields considerable information about scurvy in pre-modern China. The impression that one gets reading this text is that a high level of knowledge existed during the first half of the eighteenth century. Although scurvy did not seem to occur that often, the disease was paid minute attention as if it were a major plague. *Qingtui yagan* is thus given a fully elaborated account with a high degree of diagnostic detail. Descriptive passages alternate with prescriptive parts, and the text provides the unique opportunity to pinpoint the actual time and circumstances of the outbreak. The frequency of the occurrence of scurvy in pre-modern China is not clear. On the one hand, the text states that the disease was rarely mentioned in medical books of old, but that may not automatically imply that scurvy did not occur. On the other hand, it must be admitted that if the disease had played a major role in the health of the pre-modern Chinese, this would inevitably have been reflected in the medical literature. It did not do so, and, therefore, this specific chapter in *Yizong jinjian* deserves to be cherished. Moreover, the circumstances of the disease in this case—among soldiers operating in the north of China—directs our attention to the mainland and opens new questions about provisioning, such as, how did Chinese military forces secure their food supplies when they had to operate in distant regions where food was difficult to obtain? What methods were used to provide the builders of the Great Wall and the troops that had to guard it with sufficient food and water? And what can be said about travellers crossing the desert regions of Asia and their means of survival?⁶²

Conclusion

What may we, then, conclude from all the textual evidence presented above? Biochemical research on vitamin C has drawn attention to the particular genetic condition that theoretically could have made the problem of scurvy worse among the Chinese. This contrasts markedly with the remarkable finding that so far no cases of scurvy aboard a Chinese vessel have been documented. It is commonly

⁶¹ Own translation.

⁶² All these matters are currently being investigated.

known that, with the exception of Zheng He's voyages, the Chinese have never engaged in intercontinental ocean-going operations, but the assumption that scurvy could not possibly occur during their sea voyages because ships were never at sea for months on end has now to be somewhat readjusted. Chinese trade junks did cover considerable distances along the sea routes between China, Japan, and Southeast Asia. The idea of scurvy occurring on one of those junks is not at all unrealistic. What specifically catches the eye are the provisions and the provisioning techniques. The cases introduced above show a considerable variety of food products used by Chinese and other Asian seafarers. The presence of fruits and pickled vegetables in the diet offers an interesting perspective in connection with preventive nutrition rooted in age-old dietetic traditions. If scurvy could ever have posed a threat to Chinese sailors, it must surely have had little chance to break out, since the diets that may be reconstructed from various sources throughout China's dynastic history appear to have been well balanced. The overall impression we get is that Chinese seafarers knew very well how to prepare for long distance voyages, and that they apparently never really had to face the problem of scurvy on the scale endured during the expeditions of the Portuguese, Dutch, British and others. All this does not imply that scurvy was totally unknown in pre-modern China. People did suffer from nutritional deficiency diseases and we now know that scurvy was among them. This has been clearly proven by the chapter from the *Yizong jinjian*. The setting, however, is not maritime but continental and military. Judging from the text, the disease did not occur that often, but the medical knowledge on the affliction is inversely proportional to this rarity. The text excels in analytical detail. The attempts to trace the causes of *qingtui yagan* are worked out in the context of the field of nutrition, and the treating methods concentrate on the recovery of the separate afflicted areas and the body as a whole. It is a clear illustration of the pre-eminent Chinese notion of food that functions as medicine. In this article I have tried to create a framework for interdisciplinary research and have presented some preliminary results. More research is required on many aspects that need further clarification, and the results trigger new questions. The quest for further clarification of this matter of maritime supplies and scurvy in a Chinese context thus needs to be continued.

References

Primary Sources

- “Da Tang qiufa gaoseng zhuan” 大唐求法高僧傳 (Record of the Monks of the Great Tang in Search of the Principles). *Taishō Shinshū Daizōkyō* 大正新修大藏經, vol. 51, T.2066.

“Faxian zhuan” 法顯傳 (Biography of Faxian). *Taishō Shinshū Daizōkyō* 大正新修大藏經, vol. 51, T.2085.

Jiu Tang shu 舊唐書 (Old Standard History of the Tang). Compiled by Liu Xu et al. 劉煦, 940-945. Beijing: Zhonghua shuju, 1975.

[*Qian*] *Hanshu* [前] 漢書 (History of the Former Han). Ban Gu 班固 (58-76 AD). Beijing: Zhonghua Shuju, 1975.

Qinding gujin tushu jicheng 欽定古今圖書集成 (Imperially Approved Synthesis of Books and Illustrations Past and Present). Compiled by Chen Menglei 陳夢雷, 1726-1728. Taipei: Dingwenban, 1977 (reprint of the 1934 edition in 10,040 chapters, published by Zhonghua shuju).

Shuijing zhu 水經注 (Commentary on the Waterways Classic). Compiled by Li Daoyuan 酈道元, 515-524. Nanjing: Jiangsu guji chubanshe, 2001.

Taiping yulan 太平御覽 (Imperially Reviewed Encyclopaedia of the Taiping Era). Compiled by Li Fang 李昉 et al., 984. *Sibu congkan* 四部叢刊 (The Four Branches of Literature Collection), third series. Beijing: Zhonghua Shuju, 1960.

Tang daheshang dongzhengzhuan 唐大和上東征傳. Mahito Genkai 真人元開, 780. Annotated by Wang Xiangrong 汪向榮, 2000. Vol. 14 in *Zhongwai jiaotong shiji congkan* 中外交通史藉叢刊 (Collection of Historical Works on Chinese International Traffic History). Beijing: Zhonghua shuju.

Tang yulin 唐語林 (Collection of Tang Discourses). Compiled by Wang Dang 王讜, 1107. *Shoushan'ge congshu* 守山閣叢書. Vol. 144. Taipei: Yiwen, 1968.

Tongdian 通典 (Encyclopaedic History of Institutions). Compiled by Du You 杜佑, 801. Beijing: Zhonghua shuju, 1988, 1996³.

Xiyang fanguo zhi 西洋番國志 (Record of the Foreign Countries in the Western Oceans). Gong Zhen 龔真, 1434. Annotated by Xiang Da 向達. Beijing: Zhonghua shuju, 1961.

Yixin fang 醫心方 (Prescriptions at the Heart of Medicine). Compiled by Tamba Yasuyori 丹波康賴, 984. Edited and annotated by Shen Shunong 沈澍農. Beijing: Xueyuan chubanshe, 2001.

Yizong jinjian 醫宗金鑑 (The Golden Mirror of Medicine). Compiled by Wu Qian 吳謙, 1742. Beijing: Renmin weisheng chubanshe, 2001.

Yingya shenglan 瀛涯勝覽 (The Overall Survey of the Ocean's Shores). Compiled by Ma Huan 馬歡, c. 1435. In Feng Chengjun 馮誠均 *Yingya Shenglan Jiaozhu* 瀛涯勝覽校注. Beijing: Zhonghua Shuju, 1955.

Youyang zazu 酉陽雜俎 (Miscellany of Youyang Mountains). Compiled by Duan Chengshi, 863. Beijing: Zhonghua shuju, 1981².

Zhuangzi: Wuqiubei zhai Zhuangzi jicheng chubian 莊子: 無求備齋莊子集成初編 (First Complete Collection of the *Zhuangzi* from the Wuqiubei Studio). Edited by Yan Lingfeng 嚴靈峰. Taipei: Yiwen shuju, 1972.

Secondary Sources

Carpenter, Kenneth (1986). *The History of Scurvy and Vitamin C*. Cambridge: Cambridge University Press.

Chen Zongmao 陈宗懋 (2000). *Zhongguo chaye dacidian* 中国茶叶大辞典 (Great Chinese Dictionary of Tea). Beijing: Zhongguo qingongye chubanshe.

Chklovski, Victor (1948). *Le Voyage de Marco Polo*. Translated from the Russian by Marc Slonim. Paris: Payot, Bibliotheque Geographique.

Chu, Daniel, and Samuel Chu (1967). *Passage to the Golden Gate—a History of the Chinese in America to 1910*. New York: Zenith Books, Doubleday and Company, Inc. Garden City.

Crawford, John (1967). *Journal of an Embassy to the Courts of Siam and Cochin China*. Kuala Lumpur/ New York/ London: Oxford University Press.

Gang, Deng (1999). *Chinese Maritime Activities and Socioeconomic Development, c. 2100 B.C.-1900 A.D.* Westport, Connecticut/London: Greenwood Press.

Gibb, H. A. R. (1986). *Ibn Batutta—Travels in Asia and Africa, 1325-1354*. New Delhi: Manohar, first published in 1929 (Oriental Reprint).

Giles, Herbert A. (1956). *The Travels of Fa-hsien*. London: Routledge and Kegan Paul.

Gong Jinhan 龔錦涵 (1996). *Hanghai yixue* 航海醫學 (Maritime Medicine). Beijing: Renmin junyi chubanshe.

Hankó, László (2003). *Der Ursprung der Japanischen Vinaya-Schule Risshū 律宗 und die Entwicklung ihrer Lehre und Praxis*. Göttingen: Cuvillier Verlag.

- Heremans, J. F., and H. E. Schultze (1966). *Molecular Biology of Human Proteins*. Vol. I. Amsterdam: Elsevier Publishing Company.
- Hsia, E. C., I. Veith, and R. H. Geertsma (1986). *The True Essentials of Medicine in Ancient China and Japan: Yasuyori Tamba's Ishimpo*. Leiden: E. J. Brill.
- Huang, H. T. (2000). *Science and Civilisation in China*, Vol. VI: *Biology and Biological Technology*, Part 5: *Fermentations and Food Science*.
- Hudson, G. F. (1931). *Europe and China: a survey of their relations from the Earliest times to 1800*. London: Edward Arnold.
- Hymowitz Theodore, and J. R. Harlan (1983). "The Introduction of Soybeans to North America by Samuel Bowen in 1765." *Economic Botany*, 39 (4), pp. 371-379.
- Ishii Yoneo (1998). *The Junk Trade from Southeast Asia: Translations from Tōsen Fusetsu-gaki, 1674-1723*. Singapore: Institute of Southeast Asian Studies.
- Kiple, Kenneth (1999). *The Cambridge History of Human Disease*. Cambridge: Cambridge University Press.
- Langlois, Michel, Joris Delanghe, et al. (1996). "Biochemical and Clinical Significance of Haptoglobin Polymorphism in Man." *Clinical Chemistry* (42), pp. 1589-1600.
- Lelièvre, Dominique (1996). *Le Dragon de Lumière—Les Grandes Expéditions des Ming au Début du XVIème Siècle*. Paris: Editions France-Empire.
- Meskill, John (1965). *Ch'oe Pu's Diary: A Record of Drifting across the Sea*. Tucson: University of Arizona Press.
- Mills, J. V. G. (1970). *Ma Huan, 'Ying-yai Sheng-lan': 'The Overall Survey of the Ocean's Shores.'* Cambridge: Cambridge University Press.
- Mookerji, R. K. (1957). *Indian Shipping. A History of the Seaborne Trade and Maritime Activity of the Indians from the Earliest Times*. Bombay/ Calcutta/ Madras: Orient Longmans, first edition 1912.
- Needham, Joseph (1971). *Science and Civilisation in China*, Vol. IV: *Physics and Physical Technology*, Part 3: *Civil Engineering and Nautics*. Cambridge: Cambridge University Press.
- Niu Zhongxun 鈕仲勛 (1985). "Zheng He yuanshang yiqian Zhongguoren zai Nanhai zhi hangxing yu dili renshi" 鄭和遠航以前中國人在南海之航行與地理認識 (Chinese Nautical and Geographical Knowledge of the Chinese in the Southern Sea before Zheng He's Expeditions), in Yan Jici 嚴濟慈 (ed.) *Zheng He xia xiyang lunwen ji*. 鄭和下西洋論文集

(Collected Writings on Zheng He's Expeditions to the Western Ocean). Beijing: Renmin jiaotong chubanshe, 1985, pp. 184-195.

Nixon, J.A. (1944). "Health and Sickness in the Merchant Navy to 1815." *Proceedings of Royal Society of Medicine*, Vol. 17: "Section of the History of Medicine" (1943-...), pp. 510-512.

Quanzhouwan Songdai haichuan fajue baogao bianxiezu 泉州灣宋代海船發掘報告編寫組 (Team of Compilers of Reports on the Excavation of a Songship in the Bay of Quanzhou) (1975). *Quanzhouwan Songdai haichuan fajue jianbao* 泉州灣宋代海船發掘簡報 (Bulletin on the Excavation of a Songship in the Bay of Quanzhou). *Wenwu* 文物 (Cultural Relics) 10:1-18.

Stewart, Watt (1970). *Chinese Bondage in Peru*. Westport, Connecticut: Greenwood Press (Reprint of the 1951 edition).

Sun Guangqi 孫光圻 (1989). *Zhongguo gudai hanghai shi* 中國古代航海史 (The Ancient Maritime History of China). Beijing: Haiyang chubanshe.

Takakusu, J. (1896). *A Record of the Buddhist Religion as Practised in India and the Malay Archipelago (AD 671-695) by I-tsing*. Oxford: Clarendon Press.

Vogel, Virgil J. (1973). *American Indian Medicine*. Oklahoma: University of Oklahoma Press.

Wood, Frances (1996). *Did Marco Polo Go to China?* London: Secker and Warburg (first edition 1995).

Yan Xiamei 顏夏梅 (1996). "Zheng He xia Xiyang yu Zhongwai yiyao jiaoliu" 鄭和下西洋與中外醫藥交流 (Zheng He's Expeditions to the Western Ocean and the Exchange of Medical Drugs between China and Foreign Lands), in Fan Jinmin 范金民 (ed.) *Zouxian haiyang de Zhongguoren* 走向海洋的中國人 (Seafaring Chinese) pp. 63-69. Beijing: Haichao chubanshe.

Zheng Yijun 鄭一鈞 (1985). *Zheng He xia Xiyang* 鄭和下西洋 (Zheng He's Expeditions to the Western Ocean). Beijing: Haiyang chubanshe.